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ARTICLE

Skills and work organisation in Britain: a quarter century of change

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Abstract This paper overviews key findings concerning the evolution of job skill requirements in Britain, and their relationship to technology and work organisation, based on surveys dating from 1986. The use of skills has been rising, as indicated by several indicators covering multiple domains. Technological change is robustly implicated in these rises, but it is not possible to satisfactorily classify most tasks according to how easily they are encoded and thereby clearly link the changes to the nuanced theory of skill-biased technical change associated with asymmetric employment polarisation. Moreover, changing work organisation also contributes to explaining the rises, both in skills use and in skills development. Nevertheless, the extent of worker autonomy in the workplace declined notably during the 1990s; this decline is not accounted for by the data, but is thought to be associated with changing management culture. Changing skill requirements also affect pay. In addition to the education level both computing skills and influence skills attract a premium in the labour market. There is an increasing cost in terms of pay from overeducation and a rising prevalence of overeducation. Together, these changes are reflected in an increased dispersion of the graduate pay premium. While these findings have provided important contextual information for the development of skills policies, they have had little effect on engendering policies for stimulating improved job design.

Keywords Task-based analysis · Employee involvement · Overeducation · Pay · Task discretion · Skill demand

Fertigkeiten, Fertigkeitsanforderungen und Arbeitsorganisation in Grossbritannien: Trends über das letzten Vierteljahrhundert

Zusammenfassung In diesem Dokument werden die wichtigsten Ergebnisse zur Entwicklung von beruflichen Kompetenzanforderungen in Großbritannien sowie deren Beziehung zu Technologie und Arbeitsorganisation auf Basis von Umfragen ab dem Jahr 1986 im Überblick dargestellt. Die Kompetenzennutzung nimmt zu, wie anhand von mehreren Indikatoren, die zahlreiche Bereiche abdecken, sichtbar wird. Bei diesem Anstieg spielen technologische Veränderungen eine große Rolle. Es ist jedoch bei den meisten Aufgaben (*tasks*) unmöglich, diese angemessen zu klassifizieren und deren Veränderungen theoretisch einzuordnen. Außerdem könnte auch eine veränderte Arbeitsorganisation eine Erklärung für den Anstieg sein, sowohl bei der Kompetenzennutzung als auch bei der Kompetenzenentwicklung. In den 1990er Jahren ging jedoch das Ausmaß an Selbstständigkeit am Arbeitsplatz deutlich zurück. Dieser Rückgang lässt sich mit den Daten nicht erklären. Es wird aber davon ausgegangen, dass dies mit der veränderten Führungskultur zusammenhängt. Die

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veränderten Kompetenzanforderungen wirken sich auch auf die Bezahlung aus. Neben dem Bildungsniveau sind auch Computerkenntnisse und Überzeugungsfähigkeit auf dem Arbeitsmarkt mit einer besseren Bezahlung verknüpft. Die Lohnkosten durch Überqualifizierung steigen an, die Überqualifizierung nimmt zu. Insgesamt zeigen sich diese Veränderungen an einem zunehmenden Auseinanderdriften des Lohnzuschlags für Akademiker. Obwohl diese Ergebnisse wichtige kontextbezogene Informationen für die Entwicklung von Kompetenzstrategien bieten, haben sie bisher doch nur geringe Auswirkungen auf die Bildung von Strategien zur Verbesserung der Arbeitsgestaltung.

JEL Classification J2 · J3

1 Introduction

In recent years, the value of job requirements data has become widely appreciated for the light it sheds on the evolution of employment and the distribution of wages. Sources of such data have, however, been relatively scarce, based on surveys in only a few countries. One of these is Britain, where there is a long tradition of applying survey methods to the study of job skills, both at the employer and at the employee levels. The "Social Change and Economic Initiative" (SCELI) of 1986 included for the first time a set of questions for individuals on the broad skills requirements of their jobs. These same items were included again in the Employment in Britain survey of 1992, and in 1997 the Skills Survey added to the indicators of broad skill requirements a raft of questions on the generic skills used in jobs. Two more skills surveys were completed in 2001 and 2006, and these were followed by the Skills and Employment Survey 2012. The result is that, even though these surveys were not originally designed as a series, through careful replication of items a systematic and unusual record of change in British jobs has been assembled. Through this development of the job requirements approach, a number of valuable insights have been gained, which have shed light on theories about technological and organisational change, and have helped to mould the way that policy-makers think about the problem of skill in the British context.[1] Our objective in this paper is to provide an overview of key insights about job skills and work organisation that can be derived from these surveys.

While many of our findings are about the distributions of the generic skills among jobs in Britain, the most striking insights have concerned trends. This is an era of economic and social change, characterized and driven both by the external forces of technology and rising global competition, and by a progression of management ideas and practices, which impinge on employees' work experiences. Economics and sociology each unveil grand narratives about the evolution of skill in the modern workplace. An understanding of how workplaces have developed in practice is therefore invaluable in helping evaluate these accounts. After a brief description of the data series, we proceed, therefore, with an overview of changing skills and work organisation. Section 3 looks at the extent to which different types of skill are rewarded in British labour markets and how this has evolved over time. This discussion leads to a discussion of their valuation in the presence of skills mismatches—whereby the level of the skills held by individuals does not match the level required in the jobs they are doing. In our conclusion, we discuss the extent to which our findings have proved useful for the purposes of policy-makers.

2 The skills and employment surveys

The collection of surveys described above, running from 1986 to 2012, which are termed the Skills and Employment Surveys (SES), are a publicly available data set lodged at the UK Data Archive, both in its combined form and as separate individual surveys. All the surveys targeted representative samples of the population, in most cases those aged 20–60 living in England, Wales or Scotland. In 2006 and 2012 the age range was extended to 65. The 2006 survey was extended also to Northern Ireland and to the Highlands and Islands, a remote part of the country that is often excluded from surveys. Some other regions were also oversampled.[2] Good response rates were achieved in all the surveys. Full details of all the surveys can be found in Felstead et al. (2015) and in the references cited therein. In all the analyses we present here, consistent representative samples aged 20–60 have been used with appropriate weights, in order to obtain an unbiased account of change over time in Britain.

3 Skills and work organisation

3.1 The growth of skills use

The first, and perhaps most fundamental, issue addressed by the SES series has concerned the overall direction of skill change in modern workplaces. According to the neo-Marx-

[1] These individual level surveys have been complemented by employer surveys, including a series of employer skills surveys where the primary focus has been on vacancies and skills shortages; for the latest, see Shury et al. (2010).

[2] The SCELI data in 1986 targeted six diverse areas, and in practice achieved a sample that was representative according to occupation and industry. For 2006 some separate regional/country analyses have been carried out (e.g. Felstead 2009; Felstead and Green 2008).

ian account within sociology associated with Braverman (1974), instances of "deskilling" of craft labour that could be found in sectoral or case studies exemplified a general tendency for late 20th century capitalism. It was thought that capital strived for ever closer control of labour, and that this required knowledge and skill to be monopolised by management. "Taylorist" command and control methods of job design, and Fordist technological design, would spread inexorably while most jobs would have the skill designed out of them. Counterposing this was the "post-Fordist" perspective, which maintained that with increasing complexity of products and new technologies firms would increasingly find it profitable to allow a certain level of autonomy to workers, in order to reap productivity benefits. Not withstanding the persistence of "neo-Taylorist" job designs in the modern era, it was maintained that the overall skill level of jobs would rise. Similarly, the industrialism school within sociology had long argued that the spread of modern industry in the late 20th century would be accompanied by increasing skill demands (Blauner 1964). Such a perspective is paralleled by later economic predictions surrounding both "skill-biased" technological change and the expansion of global competition, which were expected to raise the demand for skills in developed countries (Machin and van Reenen 1998; Wood 1998). One way to address head on this issue of whether job skill levels were growing was to examine jobs directly.

In the first survey (1986) there was already a suggestion that skill levels were rising for many workers (Gallie 1991). However, this result relied on personal recall, and such changes might be associated with life-cycle effects rather than representing a social trend. Over time, however, the surveys have established an unambiguous tendency for the average skill levels of jobs to rise.

This finding derives from multiple indicators of skill, some of which are illustrated in Fig. 1. The proportion of jobs requiring graduate-level or equivalent professional qualifications is one measure of skill: this rose from 20 to 37% between 1986 and 2012. In the same period the number of jobs requiring no qualifications at all fell from 37 to 23%. Qualification requirements are, however, only one broad measure of skill, and arguably only a loose one. A similar picture of rising requirements is found for two complementary indicators between 1986 and 1997: the amount of prior learning time required to do each job, and the cumulative amount of training; however, during the 2000s these indicators stabilised and then fell a small amount, with the possible explanation that better education levels were substituting at the margin for learning on the job (see Felstead et al. 2007).

The other lines in Fig. 1 chart the changing use of various generic skills. The indices were obtained using the job requirements approach (that is, task-based analysis), by

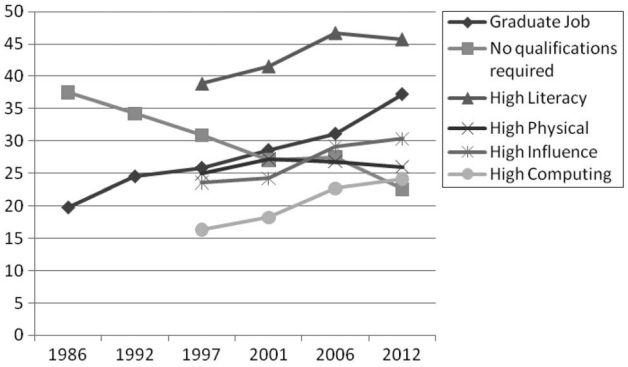

Fig. 1 Skills requirements in British Jobs, 1986–2012. (Notes: Graduate job: at least degree or equivalent needed to get job. High literacy: reading and writing activities average between "very important" and "essential". High influence: influence/communication activities average between "very important" and "essential". High Computing: computer use at complex or advanced levels. For details see Felstead et al. (2007))

combining responses to ranges of related items grouped into domains (as implied by factor analyses and indices of internal consistency). It can be seen that there were notable increases in the uses of high levels of literacy skills (reading and writing activities), influence skills (persuading, influencing, instructing) and computing skills (complex or advanced computing activities), with most of the increases coming in the period up to 2006.[3] There is little sign (yet) of any reversal of upskilling in Britain, as has been reported for the United States during the 2000s (Beaudry et al. 2013), though a notable exception is the cessation after 2006 of the rising use of high literacy skills.

Not all skills activities were evolving upwards, however. The main exception was physical skills (activities involving strength and stamina or manual dexterity), which remained relatively stable throughout the observed period. While the "knowledge society" paradigm might have led us to expect a decline in the use of these skills, the figure shows little movement, and indeed the change is statistically insignificant. Thus one can say that the use of physical skills has declined relatively, but not absolutely. Skills also increased in other domains (not shown in the diagram) but by smaller amounts.

In sum, the surveys have been decisive in rejecting the generalised "deskilling" perspective, and have established some of the key domains where job skills have been growing most rapidly. These fast-growing domains are relevant to the analysis of skills valuation, which we consider in the next section. Prior to that, however, come two key questions. First, to what extent could these changes be captured

[3] The details of these measures can be found in Felstead et al. (2007) and in Green (2009). Analysis of these trends by gender and age can be found in Gallie and Zhou (2008) and Felstead (2010) respectively.

simply by looking at the changing occupational composition of jobs? Second, are the changes consistent with the picture of skill-biased technological change? Or if not with the more "nuanced" account where the bias of change is focused in particular upon non-routine skills because these cannot be replaced by computers (Autor et al. 2003)?

The first question is central to the point of the job requirements approach, because if one could capture changes with accurate occupational indicators over time the argument for looking inside occupations would carry less force. In Green et al (2003) it is reported that the *between*-occupation proportion of the rise over 1986 to 1997 in a composite skills index (incorporating required qualifications, training and learning time indices) was less than half. Moreover, confining analyses to only those that were indicated by occupational change gave an erroneous picture of the origins of the skill change. Taking a more recent period, Green (2009) finds that the rises in literacy and influence skills that occurred *within* (2-digit) occupations were 70% and 54% respectively. Moreover, industrial re-composition had no systematic upskilling tendency. In short, the data confirmed that it would be seriously deficient to try to capture skill change solely through measures of occupational and industrial change.

Addressing the second question, we have examined the origins of the reported skill changes, through a statistical accounting exercise. In Green et al. (2003) the pattern of the 1986 to 1997 changes in qualification requirements is found to be robustly associated with rising computer usage—even though the latter is a somewhat simplistic indicator of technology. Indicators of trade exposure, by contrast, were not important. So, this particular measure of skill change was consistent with other findings within labour economics that attributed the bulk of skill increases in that period to technology (Machin and Van Reenen 1998).

Whether the British evidence is fully consistent with the nuanced view of skill-biased technological change, however, is more debatable. In the nuanced account, an asymmetric polarisation was induced by computing technologies—replacing programmable routine skills, whether manual or non-manual, with computers, but enhancing demand for higher-level cognitive and interactive skills that can best harness the productivity gains of new technologies. There was thus a relative diminution of jobs that utilised routine skills, which generally lay in the middle of the jobs spectrum for pay and skill, while low-paid but non-routine jobs were becoming relatively more important. In Britain, this polarisation was particularly evident between the late 1970s and the late 1990s (Goos and Manning 2007), though the recent picture is more complex in Britain and more generally across Europe (Salvatori 2015; Fernández-Macías 2012). In particular, there have been significant gender differences, with polarisation being most evident among men, and upgrading among women (Lindley 2015). However, notwithstanding US evidence using the Dictionary of Occupational Titles, which classified skills (using researchers' judgements) according to whether they were "routine" or not, it is difficult or impossible to satisfactorily classify anything like the full range of tasks and job skills according to whether they are easily codified. Green (2012) emphasises that this classification in practice should be treated as problematic, rather than a settled issue. For example some tasks, it was found, were being classified in opposing ways by different researchers. Jobs have been identified as "routine"—with their tasks, by implication, codifiable—where they are intensive in short repetitive tasks. While this classification has some intuitive appeal, it remains only a loose indicator of the extent to which tasks are substitutable through automation.

3.2 Skill increases and changes in work organisation

The organisation of work, in its broadest sense, is also widely found in theory and through case study research to be important alongside technology for the determination of job skills. The job requirements approach encompasses the possibility of analysing this association in considerable detail. The approach would work most fully in the context of matched employer-employee data, but there are several aspects of work organisation, those pertaining to individual jobs, that are best understood through surveys of employees. The SES series has consistently collected data on three broad concepts: task discretion, team working, and the broader concept of employee involvement. Each of these has an association with skill.

Gallie et al. (2004) developed an indicator for the concept of task discretion, which captured the extent to which an employee could influence the required tasks—the choice of methods, which tasks to perform, the pace at which they were done, and the quality standards to which they conformed. Sociological theory has long associated worker autonomy with skill (Attewell 1990), and indeed in one perspective it is included as part of the definition of skill. The SES data confirm that there is a strong association between our Task Discretion Index and other indicators of job skill. For example, the index is higher in jobs that require higher qualifications, or use computers in more complex ways, and in the traditionally more skilled occupations.

Teamworking remains controversial in its effects, even though it has been a widespread form of work organisation for some time. Partly this has been due to insufficient representative data for national populations, but it also results from the heterogeneous nature of teams. The SES data allowed us to distinguish teams according to whether they were "self-directing", defined by whether the teams had more than a certain threshold of influence over team mem-

bers' tasks. The 2006 survey also allowed us to distinguish these 'self-directed' teams further according to the extent to which the team had control over the selection of team members, team targets, and the team leader. However, no trend analysis of these 'self-managed' teams is possible given that these questions were only asked in 2006.

Team working is not necessarily expected to be associated with the skill level, but it is argued to be linked to beneficial skill development. Team working, it is hypothesised, enhances learning through multi-functional working, and through a collaborative context that provides feedback and advice between team members. Gallie et al. (2010) verify this hypothesis, but show that it is only valid for self-directing teams. Those who work in non-self-directing teams have no advantage over those who do not work in teams at all.

In another study of the effects of work organisation, we have emphasised the importance of the broader concept of "employee involvement" for skills and skills development (Felstead et al. 2010). We focused on the idea of a "high-involvement" work organisation (e.g. Wood and Bryson 2009), incorporating in principle four aspects of involvement: employee involvement in decision-making about work tasks; appraisal feedback; systems designed to reward performance and improve motivation; and mechanisms for sharing information and knowledge through the organization. While other writers had focused on the impact of high involvement on firm performance and on wages, we were interested specifically in their effect on skill formation. Using Latent Class Analysis we categorised jobs by the extent of group and individual involvement in the organisation. High group involvement jobs were ones where there was a high probability of having a great deal of team or individual influence over work tasks, of there being good communication channels (suggestion schemes, quality circles, expressive meetings etc.), and of there being an individual or group bonus scheme. We developed indicators of the quality of training, according to workers' reports of whether the training they received raised their work skills a lot, improved working practices, led to increased pay or more enjoyable work. We found that the quality of training was significantly greater in organisations that had high group involvement. We similarly found that high group involvement was robustly associated with the quality of the learning environment—as measured by the propensity to learn new things individually or in teams, and to help others learn.

Thus, as expected, both employee involvement broadly considered, and two particular features—task discretion and self-directed teamworking—are found to be positively related to skills or skills development. However, there were no particularly positive features associated with teamworking per se.

But were trends over time in these aspects of work organisation such that they could account for the long term tendency of skills to rise? The SES data have also been used to describe the overall changes in these forms of work organisation in British workplaces. Gallie et al. (2004) found that there was a substantial and statistically significant decline in task discretion during the period 1992 to 2001. This fall was not anticipated, except perhaps by those who held to the deskilling thesis. Of all the very many individual and job characteristics that are available in the data, none could account for the decline, including the changing industrial and socio-economic structure, and the gender distribution of jobs; indeed, the growing skill use measures over the period would have led one to expect rising workplace autonomy. The decline in task discretion happened in all occupation groups, and both at the top and the bottom ends of the skills distribution. It happened faster in the public sector during the 1997 to 2001 interval, a fact that might be attributable to the trend at that time in the public sector towards the adoption of targets-based management.

Our preferred explanation is that the decline in discretion is associated with trends in management culture, and that British employers were exhibiting over this period more of a preference for "command and control" approach to management. There is some evidence that the trend in task discretion differs from country to country, a fact which is more easily attributable to national cultures than to technology which is likely to be universal (Gallie 2007; Green 2006, pp. 105–7). The dynamic picture in Britain has been updated until 2012, as shown in Fig. 2. As can be seen, the decline during the 1990s was halted in 2006. After that the decline resumed in the 2006–2012 period for male employees, but there is evidence of a small improvement for females.

Perhaps it might have been argued that, with the expected rise in team working as a form of work organisation, the

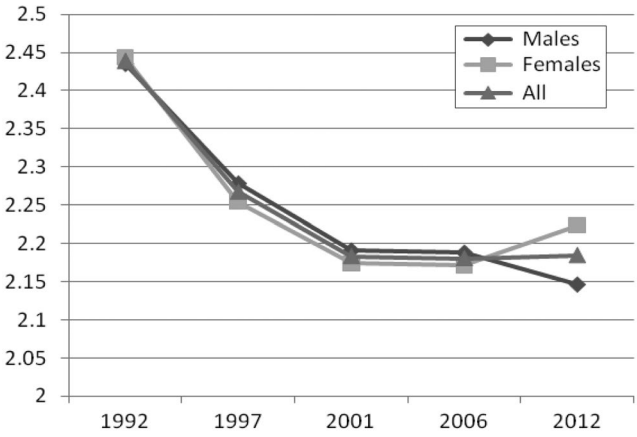

Fig. 2 Autonomy in British Workplaces. ([a]Average of 4 items (range 0–3) measuring influence over choice of work methods, which tasks to perform, the pace at which they were done, and the quality standards to which they conformed, as defined in Gallie et al. (2004); employees only). (Source: SES)

task discretion of the individual was being increasingly substituted by and subordinated by the influence of the team on tasks. Gallie et al. (2010) found that this was not the case. Looking at the period up till 2006, teamworking had indeed become more prevalent, but the decline of individual discretion was not at all counterbalanced by a rise in the proportion working in teams where there was a high level of team influence on tasks (defined as "self-directing teams"). Rather, the reverse occurred. The proportion of jobs that involve self-directing teams—the very category of team that was associated with skills development—fell from 21 % in 1992 to only 14 % in 2006. Since 2006, however, there has been a small reversal, as shown in Fig. 3: in the 2006–2012 period spanning the Great Recession the proportion of employees not working in teams continued to decline, and there was also a rise to 18 % in the proportion working in self-directing teams.

Other forms of employee involvement did, however, evolve in the right direction to prompt rises in skill needs. As can be seen in Fig. 4, between 1992/1997 and 2012 there

Fig. 3 The Prevalence of Teamworking in British Workplaces. (A "self-directing" team is defined as one which has on average "'a great deal' or 'a fair amount' of influence over work effort, the choice of tasks, the methods of carrying out tasks and quality standards"; employees only). (Source: SES)

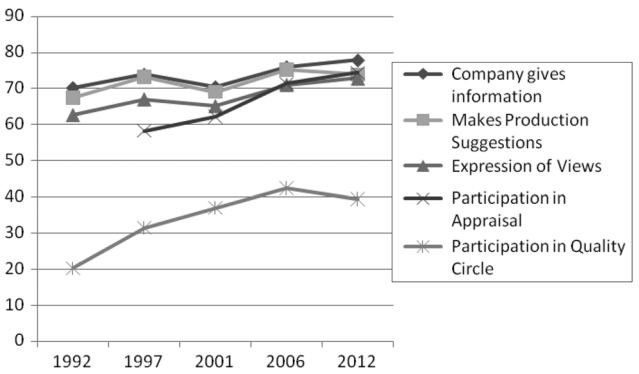

Fig. 4 Employee involvement in British workplaces: communication channels. (Source: SES)

were increases in the proportions of jobs where the company keeps employees regularly informed, where employees make suggestions for efficiency improvements, express their views at meetings, participate in appraisal schemes and in quality improvement circles. The rises in these individual-level indicators complement and confirm those found from employment surveys (Brown et al. 2009; van Wanrooy et al. 2013).

Both theory and evidence would suggest that these forms of participation and employee involvement impose certain skill needs, most notably for communication activities at various levels. Green (2012) has indeed found that the combined and separate effects of both computers and rising employee involvement can account for many of the increases in generic skills use up to 2006. Using a pseudo-panel approach with industry or occupation-based cells, it is shown that the changes in employee involvement are significant in the determination of Literacy Skills, External Communication Skills, Influencing Skills, and Checking Skills. At the same time, computing is also a major reason for rising use of Literacy, Numeracy and Influencing skills, for Self-planning and Checking tasks, and for Problem-solving skills. Thus again, the notion of skill-biased technological change is consistent with the data, but changes in work organisation provide an additional and orthogonal source of changing skill use.

4 Skills valuation and skills mismatches

4.1 The value of influence skills and computing skills

While job requirements data are useful for understanding the role of education, training and the skills supply system, as well as the consequences of technological and organisational change, perhaps their most telling potential application is in the study of pay. The idea that education or training generates skills, at some cost, which is then reflected in higher pay, is a central plank of human capital theory. The idea that skills might have an additional return in the labour market, above that which can be accounted for by known indicators of skill formation, adds further motivation. Education and prior training do not fully capture a person's work skills. Any additional premium will be either a return to unobserved acquisition costs, or a rent or quasi-rent. If the premium is substantial and is changing it becomes a candidate for explaining the changing wage distribution, especially changing within-education-group inequality.

Studies that use test-based measures of workers' own skills have typically focused on cognitive skills, which have been found to carry a substantial wage premium conditional on education. Most studies using job requirements indicators have focused on the hedonic pay premium associated

with computer use. Yet whether or not requiring computing skills in a job is a cause of higher pay has become a source of controversy. Key issues have concerned the way that computer use is measured (do indicators capture the level of complexity?), whether computer use is proxying for other skills or ability (are sufficient job controls included; can fixed effects be controlled for; or is computer use instrumented adequately to help control for endogenous selection into occupations requiring computing skills?), and the time and place to which the estimates apply. The SES data have been most important in arriving at a consensual evidence-based picture of computer skills' impact in the British labour market. In addition, however, the data have been used to investigate the association of other skill domains with pay.

UK-based studies are widely of the view that computing skills have, in recent decades, carried a labour market premium (for a review see Dolton and Pelkonen 2008). Using data from the 1997 and the 2001 surveys, applying both OLS and a within-cohort differences method, Dickerson and Green (2004) found that pay was significantly increased where the computing skills requirements were increased, and where there was a rising need to exercise "high-level communication skills" (including persuading or influencing others, making speeches or presentations, writing long reports, analysing complex problems in depth). These results were updated using the 2006 Survey in Green et al. (2007). There, an important question concerned whether computing skills had value across the spectrum, or whether they are especially highly valued in jobs which entail a high degree of social interaction—a hypothesis that is suggested by nuanced SBTC.

Table 1 updates the findings, using all of the data up to 2012. A Computing Skills Index was generated, which combined two concepts: the importance of computer use within the job and the level of sophistication or complexity with which they needed to be used. The index ranges from 0 (computers not used at all) to 4 (computers essential and used at an advanced level such as for programming). At the same time the job requirements approach was used to derive an expanded version of the high-level communication skills, termed the Influence Skills Index.[4] As can be seen, each of these indices is associated with higher pay in every year. More detailed analyses using the 2006 data found that the estimates were not substantially changed when using an instrumental variables method to try to capture for the potential endogeneity of computing skills. The instrument used was a dummy variable indicating whether new computerised equipment had recently been introduced to the workplace. The estimates were robust also in that they allowed for a very large range of additional observed controls, including several other indices of generic skills and a measure of workplace autonomy. Thus, it is unlikely that the positive coefficients could be attributed to other generic skills, even if this can never be established for certain.

Table 1 Returns to computing and influence skills over time, 1997–2012. (Source: SES 1997–2012. Employees aged 20–60 years)

Men	1997	2001	2006	2012
Computing skills	0.066***	0.083***	0.084***	0.079***
	(0.016)	(0.013)	(0.014)	(0.020)
Influence skills	0.054*	0.070***	0.050**	0.051*
	(0.022)	(0.018)	(0.015)	(0.025)
(Computing skills) # (influence skills)	0.002	0.019	0.024*	0.055***
	(0.014)	(0.012)	(0.010)	(0.015)
AME(computing skills)	0.067***	0.084***	0.086***	0.086***
	(0.016)	(0.013)	(0.014)	(0.021)
Observations	974	1798	2331	877
Adjusted R^2	0.520	0.470	0.497	0.567
Women				
Computing skills	0.066***	0.083***	0.084***	0.104***
	(0.016)	(0.012)	(0.011)	(0.016)
Influence skills	0.067***	0.061***	0.060***	0.048*
	(0.018)	(0.013)	(0.012)	(0.023)
(Computing skills) # (Influence skills)	0.009	0.011	0.041***	0.020
	(0.011)	(0.009)	(0.009)	(0.012)
AME(Computing skills)	0.065***	0.083***	0.087***	0.106***
	(0.016)	(0.012)	(0.011)	(0.016)
Observations	965	1798	2534	1129
Adjusted R^2	0.610	0.526	0.548	0.517

The dependent variable is real log hourly pay. All regressions include schooling and a quadratic in work experience in addition to the standard controls for workplace size, part-time status, public/private sector, permanent/temporary contract status, whether male or female dominated occupation, 1-digit industry dummies, region and 7 further generic skills indicators including measure of work discretion (see Gallie et al. 2004). Computing skills and influence skills were demeaned by data waves and then standardized by their pooled standard deviation. Robust standard errors in parentheses

*$p<0.05$; **$p<0.01$; ***$p<0.001$

Two notable findings can be drawn from Table 1. First, observe that by 2006 Computing Skills and Influence Skills had come to interact positively in their effect on pay. For men this positive interaction remained significant in 2012; whilst it returned to statistical insignificance among women. The average marginal effect (AME) of a one-standard deviation increase in the use of Computing Skills on men's pay rose from 6.7 to 8.6% in 2006 and 2012; for women the equivalent increase was from initial 6.6 to 8.7%in 2006 and further to 10.4% in 2012. For men who exercised above average Influence Skills these effects rose faster, whilst they did not increase at all for those at the lower end of the Influence Skills spectrum. Among women the returns to Computer Skills have grown independently of the level of Influence Skills. Thus, these findings are partly consistent with the

[4] The index is an average of item scales for: persuading or influencing others; instructing, training or teaching people; making speeches or presentations; writing long reports; analysing complex problems in depth; and planning the activities of others.

hypotheses that computers are complementary with the use of high-skilled labour (e.g. Haskell and Helden 1999).

4.2 Mismatch and skills valuation

An alternative approach to valuation using the SES data on job requirements has focused on mismatches in skills. Over time, analyses have shown an increasing gap between educational achievements and the educational qualifications required by employers (Felstead et al. 2007). This gap shows up both with individual-level analyses and with aggregated analyses of supply and demand.

From the point of view of the individual, an increase in the prevalence of "overqualification" (also referred to as "overeducation") has been observed, wherein a person holds a job for which the educational requirement to get it is lower than the level of the education held. The traditional example might be that of a graduate who works as a secretary. Such workers are often able to gain quite good secretarial jobs, and thus will typically earn more than the average secretary; but much less than their peers from university who obtain graduate jobs where employers require graduate qualifications. Many economic analyses have established this pattern in several countries (McGuiness 2006). While there remain differences of scientific opinion as to the extent to which these phenomena can be accounted for within a neoclassical framework, the position taken here is that overeducation is one of a number of fruitful ways of bringing the demand side into the analysis of pay determination. Those who would assert that only supply-side factors should be taken into consideration would have a strong case to prove.

An overqualified person can be defined as one where, in the judgment of current job-holders, the qualification level that would be needed for someone to get the job now would be below the level they have achieved (termed NVQ level 4 in the case of graduates). This judgment is subjective, and it remains the case that some jobs can be transformed by their incumbents as time passes. Nevertheless, the evidence shows that such judgments are broadly confirmed by line managers (Green and James 2003); and identical questions are asked over time. In one study (Green and Zhu 2010), it is shown that graduates in non-graduate jobs are less likely to have good quality degrees, and are also subject-related (with arts majors more prone to this condition). What the SES series reveals is that the proportion of workers who are overqualified in this sense has increased dramatically since 1986. This rise in shown, both for the case of graduates and for all workers, in Fig. 5. However, there was a reversal in 2012, especially for graduates. One factor behind this reversal is likely to be the faster increase over the 2006–2012 period in the numbers of graduate jobs, which is shown in Fig. 1.

The second way in which a gap has emerged is at the aggregate level. Using the SES data alongside Labour Force

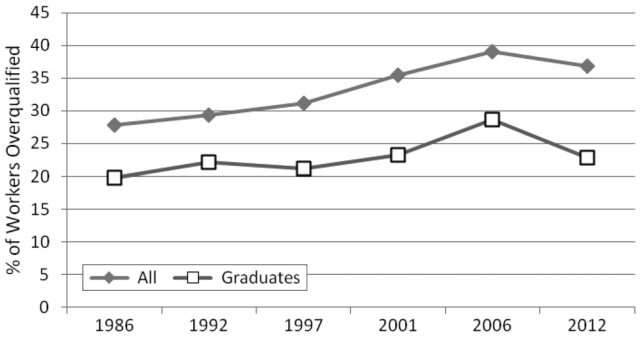

Fig. 5 Percent of overqualified workers, 1986–2012. (Source: SES)

Survey data a picture can be built up of the aggregate supplies and demands for workers at each broad level of qualifications (Felstead et al. 2007). This analysis has shown a large fall since 1986 in the numbers of jobs held by people with no qualifications, reflecting the expansion of the education system; but the numbers of jobs which require no qualifications fell much more slowly. Similarly, at the other end of the spectrum, the number of graduates in the labour force has begun, especially in recent years, to outpace the number of graduate jobs. This is why, increasingly, some graduates are finding themselves in lower-ranking jobs.

It would be expected that changing mismatches between the supply and demand for high-skilled jobs would be accompanied by changes in the skill premium for such jobs. Yet the trend in overqualification of graduates has not been found to result in a decline in the median graduate pay premium over this period. However, by the middle of the 2000s it became evident that there was an increasing dispersion in the graduate pay premium (Green and Zhu 2010). The estimated returns to Level 4 qualifications for those at the median or at the 90th percentile of the pay spectrum were increasing slightly from the mid 1990s to the mid 2000s; while the returns for those at the 10th percentile were declining. Analyses based on the SES series showed that this increasing dispersion is a reflection of the increasing overqualification up to that point shown in Fig. 5, and the linked finding that the "penalty" for being overqualified (the loss of pay compared to similarly educated peers in matched jobs) was increasing.

5 Conclusion: the impact on policy discourse

By asking consistent questions over time in surveys, tapping direct reports from job-holders on what they actually do in the course of their work, we have been able to build up a picture of change. We have reviewed some of the key findings about jobs in Britain that we have been able to uncover in the course of the last two decades.

Our focus here has been on changing skills use, the sources of this evolution, and the implications of skills and skills mismatches for pay. The key findings have been that:

- Job skill requirements (in several measures) have been rising;
- Technological change is robustly implicated in these rises, but it is not possible to satisfactorily classify most tasks as easily encoded and therefore clearly link the changes to the nuanced theory of skill-biased technical change; moreover, changing work organisation also contributes to explaining the rises, both in skills use and in skills development;
- Nevertheless, the extent of worker autonomy in the workplace has been declining;
- In addition to the education level both computing skills and influence skills attract a premium in the labour market;
- There is an increasing cost in terms of pay from skills mismatch, in particular from overeducation, which, coupled with increasing prevalence of overeducation, is generating an increased dispersion in the graduate pay premium.

This brief overview has not encompassed other actual and potential uses of the job requirements data in Britain, for example in the analysis of the sources of, and distribution of skills, other (non-pay) implications of skills, analyses of the evolution of job quality generally, and the links with work organisation, worker attitudes, worker well-being and management practices. Several issues surrounding "nuanced SBTC" have yet to be fully resolved, though perhaps a further round of data collection will enable researchers to progress understanding of the implications of growing automation for jobs and job quality.

While these findings have contributed to scholarly discourse, their value has also been recognised in policy debates (UK CES 2009). Tracing the course of such influence is by nature hazardous, given that the journey from ideas to evidence to policy impact is long, winding and often blocked. However, it is possible to see the evidence we have generated being relevant to and used by successive governments that have been steadfastly devoted to a skills-driven recovery of the country's productivity and competitiveness. In the early days of the SES, the evidence of rising skills provided an intellectual and evidence-based underpinning and rationale for its decision to concentrate its reforming efforts on skills, and in the early 2000s its expanding resources, on education and training. At a time when the "knowledge economy" was being proclaimed, the SES data provided the only quantitative nationally representative data on skills that did not rely on qualifications achievements or on changing occupational structure. This was important, since it was already recognised quite early on that qualifications were inadequate measures of skills used in workplaces, and that changing structures failed to pick up the manifest changes that were taking place within each occupation.

When, however, the rate of change of skills usage was revealed, in the later surveys, to be quite a lot slower than the pace of change of skills in the population, this posed an apparent puzzle for British skills policy. Analysts had become accustomed to a picture of skills deficiency in Britain, based on benchmarking comparisons of the supply and use of qualifications in other major industrialised nations, notably France, Germany and the United States (e.g. Steedman et al. 1991). In particular it was assumed that there was a deficiency of intermediate skills in Britain reflecting insufficient qualification supply. They were further supported in this general view by the finding that the returns to the achievement of qualifications did not seem to be falling. Yet the picture given by the SES seemed to suggest that the supply of qualifications, even at the intermediate level, was not low in relation to demand.

The resolution to this puzzle has been that the problem can be reclassified as one of both supply and demand deficiency. Analyses by the UK Commission for Employment and Skills, using both SES results and other findings, showed that, on current policies, it would not be possible to reach ambitious targets for *either* the supply of or the demand for skills in 2020 (UK CES 2009). The Commission has therefore attempted to broaden the scope of government's skills policy to include systematic links with industrial and other areas of policy, a wide engagement with employers, and forceful backing for the encouragement of "high-performance" work organisations which, it is hoped, will stimulate a greater utilisation of skill as well as enhance the development of skills in workplaces.

In addition, there is a closer attention to the detailed information that is revealed in the returns to qualifications. The returns to intermediate qualifications show considerable variation among sectors and qualification types, and in several cases have fallen to zero. And, at the graduate level, our findings described above have indicated that the benefits of education at that higher level are also becoming more differentiated. While some of that differentiation no doubt reflects increasing heterogeneity in the unobserved ability of the rising graduate population, it also comes from the heterogeneity in the jobs to which new graduates were being matched at the end of the 2000s. Analyses of the effects of the recession on the returns to graduate education may yet reveal a further widening of the gaps between graduates who are successful and those who are less successful in the labour market. The prime additional policy implication of increased dispersion in the graduate labour market is the pressing need for better information and guidance, both for undergraduates and for those still in school and choosing their subjects.

Among our findings probably the most deep-seated problem for policy has been the declining level of discretion in the workplace. Though work organisation might appear to be a private matter for employers and employees, we believe that it is possible for government to make an impact on job design. Starting in its own backyard, government can reassess its preference for top-down, command and control, management systems that appear now to be in vogue. But, as demonstrated in the Scandinavian countries, government can also assist in the raising of work quality in private industry and services, in several dimensions including autonomy. In the long-run it can have an impact through support for work-life research, and through judicious regulation, and requirements for participation. Perhaps also government can affect management's employment practices through persuasion, engagement and leadership. The UK Commission for Employment and Skills advocates that more businesses should adopt high-involvement employment practices, and if this advice were followed it would mean a reversal of the trend that we have identified. Nevertheless, given the neo-liberal environment that dominates policy-making in the current era, this is an area in which our findings have hitherto had little impact on policy-makers' thoughts.

6 Kurzfassung

In diesem Dokument werden die wichtigsten Ergebnisse zur Entwicklung von beruflichen Kompetenzanforderungen in Großbritannien sowie deren Beziehung zu Technologie und Arbeitsorganisation auf Basis von Umfragen aus den Jahren 1986 bis 2012 im Überblick dargestellt. In den letzten Jahren zeigte sich der Wert von beruflichen Kompetenzanforderungsdaten immer mehr, da anhand dieser Daten die Entwicklung der Beschäftigung und der Lohnverteilung analysiert werden kann. Dennoch gibt es nur relativ wenige relevante Datenquellen. Die Skills and Employment Surveys (SES, Umfragen zu Kompetenzen und Beschäftigung) umfassen sechs Querschnittsbefragungen mit konsistenten und repräsentativen Daten zur Kompetenzennutzung und zu Beschäftigungsverhältnissen auf dem britischen Arbeitsmarkt.

Im Einklang mit der „postfordistischen" Perspektive auf Produktionsprozesse hat die Kompetenzennutzung zwischen 1986 und 2012 zugenommen, wie anhand von mehreren Indikatoren, die zahlreiche Bereiche abdecken, sichtbar wird. Der Anteil der Stellen, für die eine Hochschulqualifikation notwendig ist, stieg beispielsweise zwischen 1986 und 2012 von 20 % auf 37 %, während der Anteil der Stellen, für die keinerlei Qualifikation notwendig ist, von 37 % auf unter ein Viertel fiel. Die neueren Trends seit 2006 könnten jedoch auf eine Abschwächung der Kompetenzennutzung hindeuten. Dies zeigt sich anhand der konstanten Nutzung von hohen Bildungskompetenzen.

Bei diesem Anstieg spielen technologische Veränderungen eine große Rolle. Die zunehmende Computerisierung dürfte einen wesentlichen Teil der verbesserten Kompetenzennutzung erklären. Die empirische Evidenz darüber, in welchem Maße Computerisierung und Automatisierung—mittels Substitution routinemäßiger kognitiver und manueller Aufgaben (tasks) durch Kapital –zur Job-Polarisierung beigetragen haben, ist weniger klar, da es bei vielen Aufgaben weiterhin unmöglich ist, diese angemessen zu klassifizieren.

Neben den technologischen Veränderungen könnte auch die veränderte Arbeitsorganisation eine Erklärung für den Anstieg sein, sowohl bei der Kompetenzennutzung als auch bei der Kompetenzenentwicklung. Mithilfe der Skills and Employment Surveys konnten Daten zu weitreichenden Konzepten der Arbeitsorganisation gesammelt werden: eigenverantwortliches Arbeiten, Teamarbeit und das weitreichendere Konzept der Mitarbeiterbeteiligung.

Eigenverantwortliches Arbeiten wird manchmal als Teil der beruflichen Kompetenz definiert. In den SES-Daten korreliert das eigenverantwortliche Arbeiten tatsächlich positiv mit anderen Dimensionen von beruflichen Kompetenzen. Im Gegensatz zum generellen Anstieg der Kompetenzennutzung nahm der Durchschnittswert für eigenverantwortliches Arbeiten zwischen 1992 und 2001 jedoch ab und blieb danach relativ konstant. Dieser Rückgang lässt sich mit den Daten nicht erklären. Es wird aber davon ausgegangen, dass dies mit der veränderten Führungskultur hin zu einer Strategie der „Führung und Kontrolle" zusammenhängt.

Teamarbeit an sich trug nicht zu einer besseren Kompetenzennutzung bei. Nur bei Teams, die Einfluss auf ihre Arbeitsaufgabe hatten, konnte die Kompetenzennutzung der Mitglieder verbessert werden.

Arbeitsorganisationen mit umfangreicher Einbindung erleichtern die Beteiligung von Mitarbeitern, indem diese in die Entscheidungen zu Arbeitsaufgaben, Bewertungssystemen, Leistungsanreizen und der Weitergabe von Informationen und Wissen in der Organisation eingebunden werden. Mitarbeiter in diesen Organisationen profitierten von hochwertigeren Schulungen und besseren Lernmöglichkeiten am Arbeitsplatz. Im Laufe der Zeit verbreiteten sich diese Praktiken immer mehr.

Die veränderten Kompetenzanforderungen wirken sich auch auf die Bezahlung aus. Neben dem Bildungsniveau sind auch Computerkenntnisse und Überzeugungsfähigkeit auf dem Arbeitsmarkt mit einer besseren Bezahlung verknüpft. Bei den Frauen stieg die Lohnprämie für Computerkenntnisse zwischen 1997 und 2012 von 6,5 % auf 10,6 %, bei den Männern von 6,7 % auf 8,4 %, also weniger stark, wobei sie seit 2001 konstant geblieben ist. Die

Bezüge stiegen jedoch bei Personen mit überdurchschnittlicher Überzeugungsfähigkeit stärker.

Die Lohnkosten der Überqualifizierung steigen, die Überqualifizierung nimmt sowohl bei Akademikern als auch in der Bevölkerung allgemein zu. Mitte der 2000er Jahre zeigte sich, dass die Lohnzuschläge für Akademiker immer weiter auseinandergedriftet sind.

Obwohl diese Ergebnisse wichtige kontextbezogene Informationen für die Entwicklung von Kompetenzstrategien bieten, haben sie bisher doch nur geringe Auswirkungen auf die Bildung von Strategien zur Verbesserung der Arbeitsgestaltung. Auch wenn sich Regierungen für die Umsetzung von Arbeitsinhalten mit stärkerer Einbindung der Beschäftigten eingesetzt haben, um den Rückgang des eher selbstbestimmten Arbeitens umzukehren, verhinderte das derzeit dominante neoliberale politische Paradigma bisher eine aktivere Rolle der Regierung bei der Gestaltung der Arbeitswelt.

References

Attewell, P.: What is skill? Work. Occup. **17**(14):422–448 (1990)

Autor, D.H., Levy, F., Murnane, R.: Computer-based technological change and skill. In: Appelbaum, E., Bernhardt, A., Murnane, R.J. (eds.) Low-Wage America. Russell Sage Foundation, New York (2003)

Beaudry, P., Green, D.A., Sand, B.M.: The great reversal in the demand for skill and cognitive tasks, National Bureau of Economic Research, Working Paper 18901 (2013)

Blauner, R.: Alienation and Freedom. The Factory Worker and his Industry. University of Chicago Press, Chicago (1964)

Braverman, H.: Labor and Monopoly Capital. Monthly Review Press, New York (1974)

Brown, W., Bryson, A., Forth, J., Whitfield, K. (eds.): The Evolution of the Modern Workplace, Cambridge University Press, Cambridge (2009)

Dickerson, A., Green, F.: The growth and valuation of computing and other generic skills. Oxford. Econ. Pap. **56**(3):371–406 (2004)

Dolton, P., Pelkonen, P.: The wage effects of computer use: evidence from WERS 2004. Brit. J. Ind. Relat. **46**(4):587–630 (2008)

Felstead, A.: Are jobs in Wales high skilled and high quality? Baselining the One Wales vision. Contemp. Wales **22**, 36–61 (2009)

Felstead, A.: Closing the age gap? Age, skills and the experience of work in Britain. Ageing Soc. (2010) (forthcoming)

Felstead, A., Green, F.: Skills at Work in Scotland, 1997–2006: Evidence from the Skills Surveys. Scottish Enterprise, Glasgow (2008)

Felstead, A., Gallie, D., Green, F., Zhou, Y.: Skills at Work, 1986 to 2006. University of Oxford, SKOPE, Oxford (2007)

Felstead, A., Gallie, D., Green, F., Zhou, Y.: Employee involvement, the quality of training and the learning environment: an individual level analysis. Int. J. Hum. Resour. Man. **21**(10):1667–1688 (2010)

Felstead, A., Gallie, D., Green, F. (eds.): Unequal Britain at Work. Oxford University Press, Oxford (2015)

Fernández-Macías, E.: Job polarization in Europe? Changes in the employment structure and job quality, 1995–2007. Work. Occup. (2012). doi:0730888411427078

Gallie, D.: Patterns of skill change—upskilling, deskilling or the polarization of skills. Work. Employ. Soc. **5**(3):319–351 (1991)

Gallie, D.: Task discretion and job quality. In: Gallie, D. (ed.) Employment Regimes and the Quality of Work. Oxford University Press, Oxford (2007)

Gallie, D., Zhou, Y.: 'Part-time work in Britain, 1992–2006', SKOPE Research Paper No 83, May. ESRC Research Centre on Skills, Knowledge and Organisational Performance, Oxford (2008)

Gallie, D., Felstead, A., Green, F.: Changing patterns of task discretion in Britain. Work. Employ. Soc. **18**(2):243–266 (2004)

Gallie, D., Zhou, Y., Felstead, A., Green, F.: Teamwork, productive Potential and employee welfare. Br. J. Ind. Relat. forthcoming (2010)

Goos, M., Manning, A.: Lousy and lovely jobs: The rising polarization of work in Britain. Rev. Econ. Statist. **89**(1), 118–133 (2007)

Green, F.: Demanding Work. The Paradox of Job Quality in the Affluent Economy. Princeton University Press, Woodstock (2006)

Green, F.: *Employee Involvement, Technology and Job Tasks*, National Institute of Economic and Social Research, Department of Economics, Discussion Paper No. 326 (2009)

Green, F.: Employee involvement, technology and evolution in job skills: A task-based analysis. Ind. Labor Relat. Rev. **65**(1), 35–66 (2012)

Green, F., James, D.: Assessing skills and autonomy: the job holder versus the line manager. Hum. Resour. Manag J. **13**(1), 63–77 (2003)

Green, F., Zhu, Y.: Overqualification, job dissatisfaction, and increasing dispersion in the returns to graduate education. Oxf. Econ. Pap. **62**(2) (2010).

Green, F., Felstead, A., Gallie, D.: Computers and the changing skill-intensity of jobs. Appl. Econ. **35**(14), 1561–1576 (2003)

Green, F., Gallie, D., Felstead, A., Zhou, Y.: Computers and pay. Natl. Inst. Econ. Rev. 201, 63–75 (2007)

Haskell, J., Heden, Y.: Computers and the demand for skilled labour: Industry- and establishment-level panel evidence for the UK. Econ. J. **109**, C68–C79 (1999)

Lindley, J.: Gender differences in job quality. In: Green, F., Felstead, A., Gallie, D. (eds.) Unequal Britain at Work. The Evolution and Distribution of Job Quality, pp. 42–61. Oxford University Press, Oxford (2015)

Machin, S., Van Reenen, J.: Technology and changes in skill structure: Evidence from seven OECD countries. Q. J. Econ. **113**(4), 1215–1244 (1998)

McGuiness, S.: Overeducation in the labour market. J. Econ. Surv. **20**(3), 387–417 (2006)

Salvatori, A.: *The Anatomy of Job Polarisation in the UK*. IZA Discussion Papers (No. 9193) (2015)

Shury, J., Winterbotham, M., Davies, B., Oldfield, K., Spilsbury, M., Constable, S.: *National Employer Skills Survey 2009* Wath-Upon-Dearne, UK Commission for Employment and Skills (2010)

Steedman, H., Mason, G., Wagner, K.: Intermediate skills in the workplace: deployment, standards and supply in Britain, France and Germany. Nat. Inst. Econ. Rev. 136, 60–76 (May) (1991)

UK CES: Ambition 2020: World Class Skills and Jobs for the UK. UK Commission for Employment and Skills, London (2009)

van Wanrooy, B., Bewley, H., Bryson, A., Forth, J., Freeth, S., Stokes, L., Wood, S.: Employment Relations in the Shadow of Recession. Palgrave Macmillan, Basingstoke (2013)

Wood, A.: Globalisation and the rise in labour market inequalities. Econ. J. **108**, 1463–1482 (1998)

Wood, S.J., Bryson, A.: High involvement management. In: Brown, W., Bryson, A., Forth, J., Whitfield, K. (eds.) The Evolution of the Modern Workplace. Cambridge University Press, Cambridge (2009)

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